

CLAIMS

What is claimed is:

- 1 1. A method for managing changes in a computer system, the method
2 comprising the steps of:
3 storing, in a storage space, undo information for removing changes that are
4 being made by a plurality of entities, wherein the undo information
5 for each entity of the plurality of entities is stored in a segment of a
6 plurality of segments within said storage space;
7 monitoring usage of the storage space by the entities; and
8 automatically adjusting at least one of the number of segments in the
9 plurality of segments and the sizes of the plurality of segments based
10 on the usage.
- 1 2. The method of Claim 1, said step of storing undo information comprising
2 associating each entity with a segment for storing the undo information of the entity
3 based on the usage.
- 1 3. The method of Claim 1, further comprising the steps of:
2 establishing a maximum amount of the storage space; and
3 preventing a sum of the sizes of the plurality of segments from exceeding
4 the maximum amount of the storage space.
- 1 4. The method of Claim 1, said step of monitoring usage further comprising
2 the step of monitoring usage in each period of time for a series of periods of time.

1 5. The method of Claim 4, said step of automatically adjusting the plurality of
 2 segments further comprising the steps of:
 3 determining whether usage has decreased over a predetermined time based
 4 at least in part on the usage in one or more periods of time of the
 5 series of periods of time; and
 6 if usage has decreased over the predetermined time, then shrinking a sum of
 7 the sizes of the plurality of segments.

1 6. The method of Claim 5, said shrinking including deleting a segment from
 2 the plurality of segments.

1 7. The method of Claim 4, said step of automatically adjusting the plurality of
 2 segments further comprising the steps of:
 3 determining whether usage has decreased over a predetermined time based
 4 at least in part on the usage in one or more periods of time of the
 5 series of periods of time; and
 6 if usage has decreased over the predetermined time, then
 7 determining whether a first amount of storage space allocated to a first
 8 segment of the plurality of segments is being used by a first entity
 9 storing undo information in the first segment, and
 10 if the first amount is not being used by the first entity, then de-allocating the
 11 first amount from the first segment.

1 8. The method of Claim 7, said step of automatically adjusting the plurality of
2 segments further comprising the steps of:

3 determining whether de-allocating the first amount leaves an amount
4 allocated to the first segment that is less than a predetermined
5 minimum amount; and
6 if de-allocating the first amount leaves less than the predetermined
7 minimum amount, then deleting the first segment.

1 9. The method of Claim 1, said step of automatically adjusting the plurality of
2 segments further comprising the steps of:

3 determining whether first conditions are satisfied; and
4 if the first conditions are satisfied, forming a new segment to store undo
5 information for a new entity.

1 10. The method of Claim 9, wherein the first conditions include that at least a
2 first amount of the storage space is not allocated to any segment of the plurality of
3 segments.

1 11. The method of Claim 9, wherein the first conditions include that every
2 segment of the plurality of segments stores undo information for at least one entity
3 of the plurality of entities.

1 12. The method of Claim 1, said step of storing undo information further
2 comprising the steps of:
3 determining whether a first segment of the plurality of segments is not
4 storing undo information for the plurality of entities; and
5 if the first segment is not storing the undo information for the plurality of
6 entities, storing undo information for a new entity in the first
7 segment.

1 13. The method of Claim 1, said step of automatically allocating the resource
2 further comprising:
3 determining based on the usage whether a first amount of the resource
4 allocated to a first segment is not currently used by the plurality of
5 entities; and
6 if the first amount is not currently used, associating a new entity with the
7 first amount of the resource.

1 14. The method of Claim 1, wherein:
2 a first entity of the plurality of entities is associated with a first segment of
3 the plurality of segments; and
4 said step of automatically adjusting the plurality of segments further
5 comprises increasing a size of the first segment in response to a
6 request from the first entity by allocating an additional amount of the
7 storage space to the first segment.

1 15. The method of Claim 14, said step of automatically adjusting the plurality of
2 segments further comprising:

3 determining whether sufficient storage space is already allocated to the first
4 segment for storing undo information included in the request from
5 the first entity; and

6 if it is determined that sufficient storage space is not already allocated to the
7 first segment, then performing said step of increasing the size of the
8 first segment.

1 16. The method of Claim 15, wherein a sum of the additional amount and the
2 storage space already allocated to the first segment is sufficient for storing the undo
3 information included in the request from the first entity.

1 17. The method of Claim 15, wherein the additional amount is based on the
2 storage space already allocated to the first segment.

1 18. The method of Claim 14, wherein the additional amount is selected from a
2 plurality of predetermined amounts.

1 19. The method of Claim 14, said step of allocating the additional amount
2 further comprising:

3 determining whether the additional amount of the storage space is available
4 in storage space not currently allocated to the plurality of segments;
5 and

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6 if the additional amount of the storage space is available in storage space not
7 currently allocated to the plurality of segments, then obtaining the
8 additional amount of storage space from the storage space not
9 currently allocated.

1 20. The method of Claim 14, wherein:
2 a set of one or more entities of the plurality of entities is alone associated
3 with a second segment of the plurality of segments; and
4 said step of allocating the additional amount further comprises:
5 determining whether the additional amount of the storage space is currently
6 allocated to the second segment of the plurality of segments and is
7 not used by the set of one or more entities; and
8 if the additional amount of the storage space is currently allocated to the
9 second segment and is not used by the set, then obtaining the
10 additional amount of storage space by de-allocating from the second
11 segment the storage space currently allocated to the second segment
12 and not used by the set.

1 21. The method of Claim 4 said step of monitoring usage in each period of time
2 further comprising the step of monitoring an amount of the undo information stored
3 in each period of time.

1 22. The method of Claim 4, said step of monitoring usage in each period of time
2 further comprising the step of monitoring a number of entities started in each period
3 of time.

1 23. The method of Claim 4, said step of monitoring usage in each period of time
 2 further comprising the step of monitoring a maximum number of entities executing
 3 concurrently in each period of time.

1 24. The method of Claim 4, said step of monitoring usage in each period of time
 2 further comprising the step of monitoring a maximum duration in each period of
 3 time among durations of queries terminating during the period of time, said queries
 4 using at least some of the undo information stored in the storage space.

1 25. The method of Claim 14, wherein the additional amount is an extent of
 2 contiguous storage space.

1 26. The method of Claim 1, the step of automatically adjusting the plurality of
 2 segments further comprising the steps of:

3 allocating unused amounts of the storage space to the plurality of segments
 4 in response to receiving undo information from the plurality of
 5 entities; and
 6 de-allocating unused amounts of the storage space from the plurality of
 7 segments periodically.

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1 27. A method for managing changes in a computer system, the method
2 comprising the steps of:
3 storing, in a storage space, undo information for removing changes that are
4 being made by a plurality of entities, wherein the undo information
5 for each entity of the plurality of entities is stored in a segment of a
6 plurality of segments within said storage space, and a first entity of
7 the plurality of entities is associated with a first segment of the
8 plurality of segments, and a set of one or more entities of the
9 plurality of entities is alone associated with a second segment of the
10 plurality of segments;
11 monitoring usage of the storage space by the entities in each period of time
12 for a series of periods of time; and
13 automatically adjusting at least one of the number of segments in the
14 plurality of segments and the sizes of the plurality of segments based
15 on the usage, said step of automatically adjusting comprising:
16 determining whether usage has decreased over a predetermined time
17 based at least in part on the usage in one or more periods of
18 time of the series of periods of time;
19 if usage has decreased over the predetermined time, then shrinking a
20 sum of the sizes of the plurality of segments;
21 determining whether sufficient storage space is already allocated to
22 the first segment for storing undo information included in a
23 request from the first entity; and

24 if it is determined that sufficient storage space is not already
25 allocated to the first segment, then increasing the size of the
26 first segment by allocating an additional amount of the
27 storage space to the first segment, said step of allocating the
28 additional amount comprising,
29 determining whether the additional amount of the storage
30 space is available in storage space not currently
31 allocated to the plurality of segments, and
32 if the additional amount of the storage space is available in
33 storage space not currently allocated to the plurality
34 of segments, then obtaining the additional amount of
35 storage space from the storage space not currently
36 allocated; and

37 if the additional amount of the storage space is not available
 38 in storage space not currently allocated to the
 39 plurality of segments, then determining whether the
 40 additional amount of the storage space is currently
 41 allocated to the second segment of the plurality of
 42 segments and is not used by the set of one or more
 43 entities, and if the additional amount of the storage
 44 space is currently allocated to the second segment and
 45 is not used by the set, then obtaining the additional
 46 amount of storage space by de-allocating from the
 47 second segment the storage space currently allocated
 48 to the second segment and not used by the set.
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1 28. A computer-readable medium carrying instructions for managing changes in
 2 a computer system, the instructions causing one or more processors to perform the
 3 steps of:
 4 storing, in a storage space, undo information for removing changes that are
 5 being made by a plurality of entities, wherein the undo information
 6 for each entity of the plurality of entities is stored in a segment of a
 7 plurality of segments within said storage space;
 8 monitoring usage of the storage space by the entities; and

9 automatically adjusting at least one of the number of segments in the
10 plurality of segments and the sizes of the plurality of segments based
11 on the usage.

1 29. The computer-readable memory of Claim 28, said step of storing undo
2 information comprising associating each entity with a segment for storing the undo
3 information of the entity based on the usage.

1 30. The computer-readable memory of Claim 28, the instructions further
2 causing the one or more processors to perform the steps of:
3 establishing a maximum amount of the storage space; and
4 preventing a sum of the sizes of the plurality of segments from exceeding
5 the maximum amount of the storage space.

1 31. The computer-readable memory of Claim 28, said step of monitoring usage
2 further comprising the step of monitoring usage in each period of time for a series
3 of periods of time.

1 32. The computer-readable memory of Claim 31, said step of automatically
2 adjusting the plurality of segments further comprising the steps of:
3 determining whether usage has decreased over a predetermined time based
4 at least in part on the usage in one or more periods of time of the
5 series of periods of time; and
6 if usage has decreased over the predetermined time, then shrinking a sum of
7 the sizes of the plurality of segments.

1 33. The computer-readable memory of Claim 32, said shrinking including
2 deleting a segment from the plurality of segments.

1 34. The computer-readable memory of Claim 31, said step of automatically
2 adjusting the plurality of segments further comprising the steps of:
3 determining whether usage has decreased over a predetermined time based
4 at least in part on the usage in one or more periods of time of the
5 series of periods of time; and
6 if usage has decreased over the predetermined time, then
7 determining whether a first amount of storage space allocated to a
8 first segment of the plurality of segments is being used by a
9 first entity storing undo information in the first segment, and
10 if the first amount is not being used by the first entity, then de-
11 allocating the first amount from the first segment.

1 35. The computer-readable memory of Claim 34, said step of automatically
2 adjusting the plurality of segments further comprising the steps of:
3 determining whether de-allocating the first amount leaves an amount
4 allocated to the first segment that is less than a predetermined
5 minimum amount; and
6 if de-allocating the first amount leaves less than the predetermined
7 minimum amount, then deleting the first segment.

1 36. The computer-readable memory of Claim 28, said step of automatically
2 adjusting the plurality of segments further comprising the steps of:
3 determining whether first conditions are satisfied; and
4 if the first conditions are satisfied, forming a new segment to store undo
5 information for a new entity.

1 37. The computer-readable memory of Claim 36, wherein the first conditions
2 include that at least a first amount of the storage space is not allocated to any
3 segment of the plurality of segments.

1 38. The computer-readable memory of Claim 36, wherein the first conditions
2 include that every segment of the plurality of segments stores undo information for
3 at least one entity of the plurality of entities.

1 39. The computer-readable memory of Claim 28, said step of storing undo
2 information further comprising the steps of:
3 determining whether a first segment of the plurality of segments is not
4 storing undo information for the plurality of entities; and
5 if the first segment is not storing the undo information for the plurality of
6 entities, storing undo information for a new entity in the first
7 segment.

1 40. The computer-readable memory of Claim 28, said step of automatically
2 allocating the resource further comprising:
3 determining based on the usage whether a first amount of the resource
4 allocated to a first segment is not currently used by the plurality of
5 entities; and
6 if the first amount is not currently used, associating a new entity with the
7 first amount of the resource.

1 41. The computer-readable memory of Claim 28, wherein:
2 a first entity of the plurality of entities is associated with a first segment of
3 the plurality of segments; and
4 said step of automatically adjusting the plurality of segments further
5 comprises increasing a size of the first segment in response to a
6 request from the first entity by allocating an additional amount of the
7 storage space to the first segment.

1 42. The computer-readable memory of Claim 41, said step of automatically
2 adjusting the plurality of segments further comprising:
3 determining whether sufficient storage space is already allocated to the first
4 segment for storing undo information included in the request from
5 the first entity; and
6 if it is determined that sufficient storage space is not already allocated to the
7 first segment, then performing said step of increasing the size of the
8 first segment.

1 43. The computer-readable memory of Claim 42, wherein a sum of the
 2 additional amount and the storage space already allocated to the first segment is
 3 sufficient for storing the undo information included in the request from the first
 4 entity.

1 44. The computer-readable memory of Claim 42, wherein the additional amount
 2 is based on the storage space already allocated to the first segment.

1 45. The computer-readable memory of Claim 41, wherein the additional amount
 2 is selected from a plurality of predetermined amounts.

1 46. The computer-readable memory of Claim 41, said step of allocating the
 2 additional amount further comprising:
 3 determining whether the additional amount of the storage space is available
 4 in storage space not currently allocated to the plurality of segments;
 5 and
 6 if the additional amount of the storage space is available in storage space not
 7 currently allocated to the plurality of segments, then obtaining the
 8 additional amount of storage space from the storage space not
 9 currently allocated.

1 47. The computer-readable memory of Claim 41, wherein:
 2 a set of one or more entities of the plurality of entities is alone associated
 3 with a second segment of the plurality of segments; and
 4 said step of allocating the additional amount further comprises:

5 determining whether the additional amount of the storage space is
6 currently allocated to the second segment of the plurality of
7 segments and is not used by the set of one or more entities;
8 and
9 if the additional amount of the storage space is currently allocated to
10 the second segment and is not used by the set, then obtaining
11 the additional amount of storage space by de-allocating from
12 the second segment the storage space currently allocated to
13 the second segment and not used by the set.

1 48. The computer-readable memory of Claim 31, said step of monitoring usage
2 in each period of time further comprising the step of monitoring an amount of the
3 undo information stored in each period of time.

1 49. The computer-readable memory of Claim 31, said step of monitoring usage
2 in each period of time further comprising the step of monitoring a number of
3 entities started in each period of time.

1 50. The computer-readable memory of Claim 31, said step of monitoring usage
2 in each period of time further comprising the step of monitoring a maximum
3 number of entities executing concurrently in each period of time.

1 51. The computer-readable memory of Claim 31, said step of monitoring usage
2 in each period of time further comprising the step of monitoring a maximum
3 duration in each period of time among durations of queries terminating during the
4 period of time, said queries using at least some of the undo information stored in the
5 storage space.

1 52. The computer-readable memory of Claim 41, wherein the additional amount
2 is an extent of contiguous storage space.

1 53. The computer-readable memory of Claim 28, the step of automatically
2 adjusting the plurality of segments further comprising the steps of:
3 allocating unused amounts of the storage space to the plurality of segments
4 in response to receiving undo information from the plurality of
5 entities; and
6 de-allocating unused amounts of the storage space from the plurality of
7 segments periodically.